The AARConverter
A Top Band Receiving Converter for use with the AARCmitter

by KR8L

(Not on 160 meters? Don't stop reading! This simple converter can also be used to add reception of one or more WARC-79 bands to an older transceiver or ham band receiver.)

Funny how first impressions stay with you and influence your opinion of things for a long time. I remember two from my early days as a ham: (1) Don't get on 20 meters, boy! There are nothing but big guns and DXers up there. Don't even try to engage anybody in a casual rag-chew on that band! (2) It requires some really big equipment to get on Top Band. Big coils, big caps, big tubes, big antennas. Not a place for the average ham! (Probably influenced by the fact that very few rigs included 160 meters in those days.)

I gradually learned through experience that hams on 20 meters are just hams. Lots of rag-chewers as well as DXers, QRP as well as QRO types, and many good times had and friendships made. Top Band always held a fascination for me, but I figured I'd probably never have a chance to try it. All that changed many years ago when some enterprising hams in the Argonne Amateur Radio Club developed the AARCmitter (Reference 1), a crystal controlled, QRP CW transmitter for Top Band. That rig was offered as a kit, and gave me my first experience on 160 meters. That was followed, of course, by the AARCmodulator (Reference 2), which converted the AARCmitter to AM. Several years later I developed and published my own version of the rig which included a VFO: the AARCmitter-II (Reference 3), which has given me more opportunities to experience the fun and challenge of Top Band.

All of my Top Band operation to date has made use of my Kenwood R-1000 general coverage receiver. This is a great receiver for general broadcast and utility listening, but is not well suited for ham use. The filters are too broad, and the 1 MHz to 2 MHz portion of the tuning range suffers badly from spurious responses to medium wave broadcast stations. I have been meaning to build a converter to use with my Ten-Tec Argosy for a long time, but kept putting it off. Well, this winter I finally did it. I'm really pleased with the performance, and in honor of the creators of the original club project for this band, I've chosen to name it the AARConverter.

Please refer to the attached schematic for the AARConverter. The heart of the converter is the Mini Circuits SBL-1 diode double balanced mixer, which I purchased from Ocean State Electronics (Reference 4). This is a neat little mixer in a DIP configuration. Although a diode DBM typically exhibits about 6 dB of conversion loss, I have avoided the use of any active stages or other non-linear devices ahead of the SBL-1, in order to minimize the chance of interference from strong broadcast band signals. The local oscillator uses an MPF102 FET (Radio Shack no. 276-2062)

configured as a Colpitts oscillator, using an inexpensive ($1.25) 12.000 MHz microprocessor crystal, also from Ocean State Electronics. The oscillator is followed by another MPF102 serving as a buffer in a source follower configuration.

The source follower directly feeds the diode DBM and, when operating from a 9 v transistor radio battery, provides close to the +7 dBm of drive specified for the SBL-1. Operating the converter from a 12 v supply increases the drive to considerably above +7 dBm, but I was not able to detect any difference in performance at this level, leading me to conclude that an additional stage of amplification is not needed. The mixer output goes directly to the output jack, and from there to the receiver. Although this may not be a textbook example of how to properly terminate the mixer, once again I found the performance to be more than adequate as-is, leading me to opt for “simple” rather than “ideal.”

The only resonant circuit in the converter is the tuned transformer ahead of the mixer. The 22 MHz image frequency should seldom be open for propagation at the same time that I want to listen to 160 meters, so I concluded that this would provide adequate selectivity. So far, experience has proven me correct (although we <u>are</u> at the bottom of the sunspot cycle!). The secondary of the transformer is 55 turns of #26 enameled wire on a T-94-2 toroidal core, tapped six turns from the ground end. The primary is six turns wound over the ground end. For tuning, I found a 220 pf mica compression trimmer in my junk box and paralleled it with a 100 pf polystyrene capacitor. This particular trimmer has a short shaft with a screwdriver slot, so I placed the trimmer on the circuit board so that the shaft could be turned with a screwdriver through an access hole in the cabinet. Although most of my operation is in the low end of the band, I can easily repeak the tuned circuit if I want to listen at the high end. In practice, retuning is only necessary for an excursion of over 100 kHz, or so.

I constructed the converter on a small Radio Shack circuit board (no. 276-148), using point-to-point wiring. The oscillator, source follower, and mixer are on one half of the board, and the toroid and trimmer capacitor are on the other half. The board is installed in an LMB mini-box (2” x 3” x 4”) with SO-239s for input and output on the back, the switch is on the front, and the access to the trimmer is on the top. I installed a 9 v battery clip and battery inside the box, and added small rubber stick-on feet to the bottom.

Alignment is most simple. Tune your receiver to a frequency between 10.0 MHz and 10.2 MHz, and connect the converter to the receiver. Connect an antenna to the converter. Nothing should be heard at this point. (If you <u>do</u> hear any signals, you have a problem, as the DBM should provide isolation between the antenna and the receiver until the local oscillator is present.) Turn on the switch and peak the tuned circuit using an available signal, or just the background noise on the band. To operate the converter you will tune from 10.2 MHz to 10.0 MHz in order to receive 1.8 MHz to 2.0 MHz. Be sure to set your receiver to USB in order to receive the LSB signals from 160 meters. (Note that the converter is <u>inverting</u> and that the tuning is <u>backwards</u> because the intermediate frequency is below the local oscillator frequency.)

Well, that's about all there is to the AARConverter. If you're not interested in Top Band, but would like to add 30 and/or 17 meter reception to a pre-WARC-79 rig (for example), you could easily modify the circuit by installing a 4 MHz crystal, changing the tuned circuit to resonate at 10 and/or 18 MHz, and tuning your receiver to 20 meters. (Microprocessor crystals for 4 MHz are readily available in the $1 price range.) Additional input selectivity might be needed, also. You will have to experiment to find out.

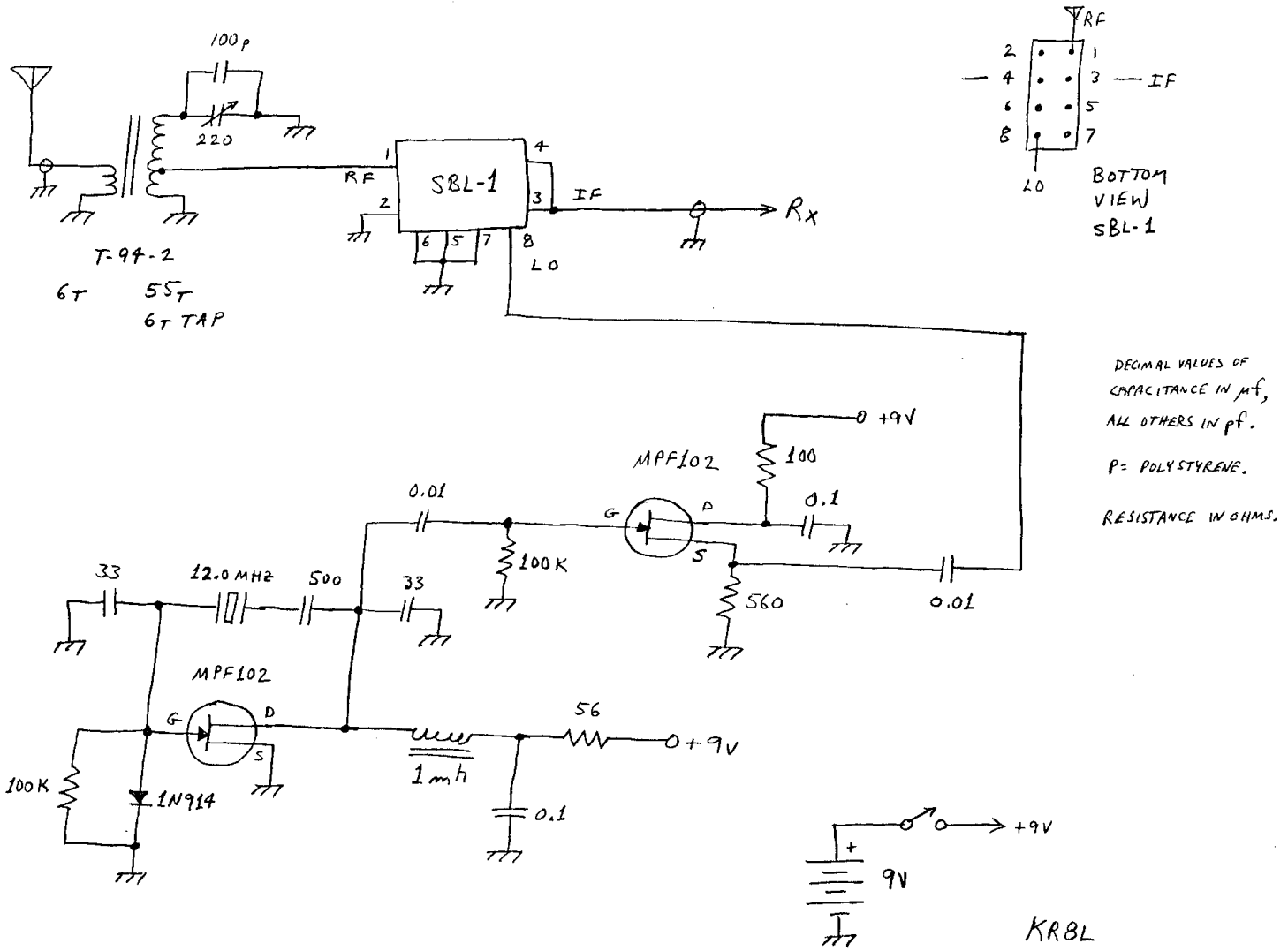
References:

1. The AARCMITTER 160 Meter Transmitter, Argonne Amateur Radio Club, K9CZB and W9GBL, 1988

2. The AARC-MODULATOR Amplitude Modulator for the 160 Meter AARC-Mitter Transmitter, Argonne Amateur Radio Club, K9CZB and W9GBL, 1988

3. The AARCmitter II, A VFO Controlled, 1.5 Watt Transmitter for 160 Meters; Radioactivities, Volume XXXIV, Number 7, July 1993; and Volume XXXIV, Number 9, August 1993; KR8L

4. Ocean State Electronics, P. O. Box 1458, Westerly, RI 02891, Information: (401) 596-3080, Orders: (800) 866-6626


100p
220
T-94-2
6T
55T
6T TAP
SBL-1
RF
IF
LO
Rx
RF
IF
LO
BOTTOM VIEW SBL-1
0 +9V
MPF102
100
0.1
0.01
100K
33
12.0 MHz
500
33
560
0.01
MPF102
56
100K
1N914
1mh
0.1
+9V
9V
DECIMAL VALUES OF CAPACITANCE IN μf, ALL OTHERS IN pf.
P= POLYSTYRENE.
RESISTANCE IN OHMS.
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